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AUTHOR Morocco, Catherine Cobb; And Others
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ABSTRACT

This report presents first year (1984-85) findings of The Writing Project, a 2-year school-based study of the use of word processing to improve learning-disabled children's writing skills. Emphasis is on how remedial teachers can integrate computers into their writing activities in resource rooms and classrooms. Based in three Massachusetts school districts, the project focused in the first year on intensive observation of 14 fourth-grade children as they wrote with word processors. The study found that the computer aided the child's sense of ownership, of being in control and "authoring" the writing, and of his/her involvement in writing. Teachers brought three different approaches to teaching writing with a computer: skill building; guided writing; and strategic. The strategic approach, which provided students with strategies for managing the writing process, appeared to result in the highest level of student involvement and independent work. The skill building approach resulted in the least positive impact on students' involvement and sense of ownership. A model environment for teaching writing with computers is proposed, guided by such principles as the basic capability of learning-disabled children as "authors" and the use of writing strategies that keep the child in control. Includes 21 references. (DB)

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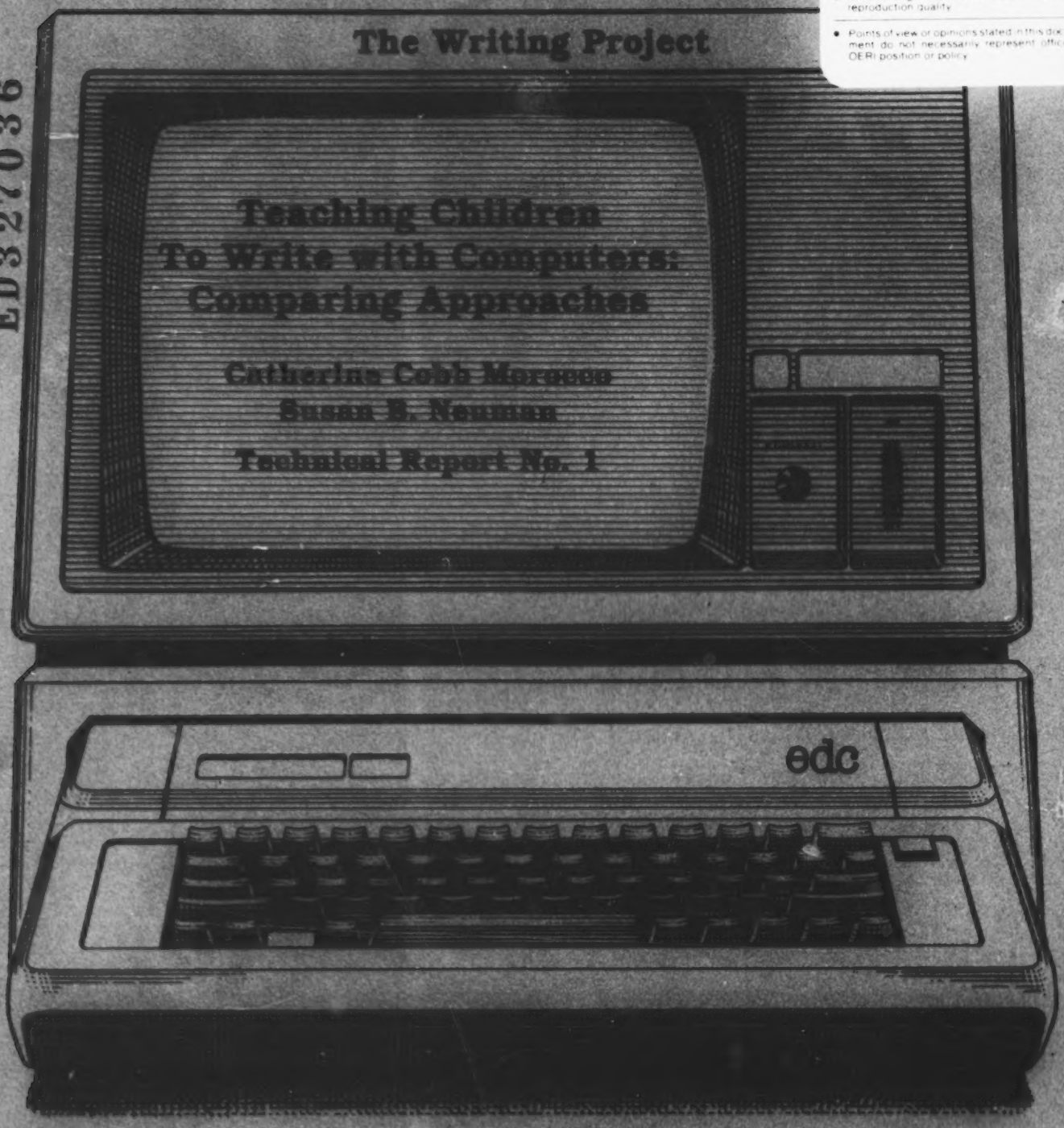
The Writing Project

# Teaching Children To Write with Computers: Comparing Approaches

Catherine Cobb Morocco
Susan B. Neuman

Technical Report No. 1




Education Development Center
55 Chapel Street, Newton, MA 02160

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This report presents first year (1984-85) findings of The Writing Project, a two-year school-based study of the use of word processing to improve children's writing skills. Funded by the U.S. Office of Education, Special Education Programs, the project is exploring how remedial teachers can integrate computers into their writing activities in resource rooms and substantially separate classrooms. Based in three Massachusetts school districts, the project focused in the first year on intensive observation of fourteen fourth grade children as they wrote with word processors. A companion report (Technical Report No. 1) is also available for distribution.

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- Robert E. Boyd, Assistant Superintendent for PSS-SPED, Brookline Public Schools;

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- Patrick J. Murphy, Assistant Director of the Bureau of Pupil Services, Cambridge School Department.

This and other reports can be obtained from:

The Writing Project
Catherine Cobb Morocco, Director
Educational Development Center
55 Chapel Street
Newton, MA 02160

# TEACHING CHILDREN TO WRITE WITH COMPUTERS: COMPARING APPROACHES

Catherine Cobb Morocco
Susan B. Neuman

with

Marian Bullock
Martin Luther King School, Cambridge

Helen Cushman
Bridge School, Lexington

Amy E. Neale
Driscoll School, Brookline

Debra Packard
Lexington Special Education Department

Dawna Traversi
Graham and Parks School, Cambridge

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## INTRODUCTION

It is not unusual to find children reluctant to write. This is particularly true for the many students, currently referred to as "learning disabled," who spend five to seven hours per week in tutorial or resource room settings to work on writing (Poplin 1980; Lerner 1976). By the time they reach fourth and fifth grade most of these students believe they lack the skills needed for writing and in many cases believe they have nothing to say.

An increasing number of teachers and researchers are exploring the potential use of word processors as writing tools for low-writing students (Behrman 1984; MacArthur 1984). The hope is that the computer will be a more engaging tool than the pencil, that it will cramp the hand less than conventional writing tools, and make revision easier. Presumably, if children are more willing to write, and write and revise more, the overall quality of their products will improve.

This paper presents the results of the first year of a two year study of how remedial teachers can use word processors to improve learning disabled children's writing. A systematic analysis of observation and interview data at the end of the first year addressed the question of how teachers were approaching the teaching of writing on the computer, and what impact those approaches were having on students' writing process. Because teachers were exploring new teaching methods and did not have a consistent writing program or "treatment," the analysis focuses on writing processes affected by the computer, rather than writing product outcomes.

Two attitudinal variables emerged as critical during the early months of field observations. One is the child's sense of ownership, of being in control or

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"authoring" the writing. The other is involvement in writing, the child's attention to the composing process, and the content of the writing. Teachers brought three different approaches to teaching writing with a computer, which we have termed skill building, guided writing, and strategic. These approaches varied dramatically in their impact on children's ownership and involvement in writing.

The paper describes the role of the computer in each approach and discusses the impact of each approach on the child's writing process. Finally the paper outlines directions for a model teaching environment which integrates the most promising approaches for using word processors with learning disabled children.

## RESEARCH METHOD

Education Development Center is carrying out the Writing Project in collaboration with five remedial teachers from three Boston area school districts. The teachers are considered exemplary in their systems, and have between one and four year's experience using microcomputers with mildly handicapped children. The fourteen (2-3 per remedial setting) fourth grade students selected for the first year sample represent diverse socio-economic and ethnic backgrounds and have varying degrees of learning difficulties. The eleven students in resource room and tutorial settings spend approximately five hours per week there; three students have their entire program in a substantially separate classroom.

Students' writing problems varied widely. Some students were strong in expressing ideas, but weak in attention and in knowledge of mechanical and spelling conventions; others had a basic mastery of sentence skills but disliked writing and had difficulty generating ideas. Students in the substantially separate classroom were two to three years behind grade level in reading and math, and had difficulty forming coherent, grammatically correct thoughts in writing. Writing problems, noted in this particular sample, appeared to parallel studies of writing research for LD children (Bereiter, 1980).

The study combines intensive ongoing classroom observation with periodic teacher interviews and monthly teacher-researcher meetings to facilitate information sharing. The approaches outlined in the next section emerged from our anlaysis of observations and interviews carried out between October and May 1984-85. Interviews focused on the teachers' goals for teaching writing, philosophy and self-described approaches to teaching writing, views of the writing problems of "learning disabled" children, and expectations about computer benefits and problems.

The observation method chosen was one that would capture as complete and rich as possible a picture of the interactions taking place between teachers, children and computers. Trained observers placed portable taperecorders near teacher-child conferences, and beside the computer, when children were composing there. Simultaneously, observers kept a running record of general classroom activity, recorded the child's text as it appeared on the computer monitor, and noted difficulties the child had with keyboarding. Following the observation, researchers transcribed major sections of the tapes, integrating information from the running record with verbal exchanges.

Teachers were encouraged to explore new ways of using the computer to teach writing skills. Research staff did not prescribe any particular approach during the first year, in order to study what remedial teachers "naturally" bring to this new teaching field. The teachers continually evolved in their work with word processors, through their own experimenting and through exchanging ideas and materials. Nevertheless, our observations indicate a certain consistency in the general frameworks that underlie and guide the teachers' approaches to using word processors in writing instruction. These perspectives, broadly defined as falling into three categories: skill building, guided writing, and strategic, include not only assumptions about the writing process but also about the capabilities and needs of the LD child.

The discussion of each approach below includes the teacher's assumptions about writing and the LD child, the role of the word processor, and the impact of that approach on the child's sense of ownership and engagement in writing. Figure 1 summarizes the main features of each approach.

FIGURE 1

Three Approaches to
Teaching Writing to LD Children

| Approach | Assumptions about Writing | Writing Needs of LD Children | Teacher Role | Computer Role |
|---|---|---|---|---|
| Skill Building | Writing involves the mastery of simple to more complex units of written language and the mastery of writing conventions | LD children have difficulty generating ideas without a guiding structure, and have major deficits in writing mechanics and conventions | To provide models for the child's writing product; to provide direct practice in the specific writing skills the child lacks. | Facilitates re-reading to identify errors; facilitates deletion and correction |
| Guided Writing | Writing is a process of formulating ideas and translating them into writing; inexperienced writers need to compose and edit at separate times | LD children have ideas to express, but problems with attention, confidence, organization and mechanics make it difficult for them to engage in sustained, independent composing | To guide and facilitate the child's generating, expanding, and organizing of ideas | Facilitates re-reading to keep child engaged in text, and to enable teacher to guide and prompt the child; facilitates insertion and expansion of text |
| Strategic | Writing requires coordinating several mental processes that recur through the writing process, including focusing a topic, planning for audience, generating and revising ideas | LD children need to acquire the planning, organizing, reviewing, and revising strategies required in order to manage the writing process | Help children acquire strategies which they can apply to writing in any setting | Make child's text and writing process accessible for teacher intervention; reflect back child's ideas; potentially, to provide model planning, organizing, revising strategies. |

## APPROACHES

### SKILL BUILDING

This approach breaks down writing into sub-skills and gives children the opportunity to practice and understand the skills that appear lacking in their written products. Children develop skill in writing complete sentences of varied patterns, and then learn to construct paragraphs from a group of sentences. Rules or principles that guide correct word choice are taught, and writing conventions related to capitalization, punctuation, indenting and organizing, form a major portion of writing instruction. This approach reflects a basic assumption that writing evolves from the mastery of simple to more complex units of written language. This "hierarchical" view has been largely articulated in the language disorder field by Myklebust (1973) and others.

This approach assumes that learning disabled children tend to be easily distracted and are not able to work on long tasks. They will have a great deal of difficulty getting ideas down on paper without a structure within which to generate ideas. A lack of skills in writing conventions, such as rules for spelling, punctuating and paragraphing, is their most critical "deficit." The approach assumes that in mastering these basic skills the child will be proud of and "own" the final product.

For writing activities, teachers give children guiding structures, or "models" for the kind of writing they are to produce. For example, if children are working on writing complete sentences, they might provide a sentence model such as Actor, Action, Location (Figure 2) to use in composing sentences. To help them write descriptive paragraphs, teachers may give children a "frame" to guide their selection of content and organize the final paragraph (Figure 3). Alternatively, teachers may have the child answer series of questions on a single topic (Figure 4). Those answers become the substance of a paragraph on that topic.

## Computer Role

Several features of word-processing programs can facilitate this approach. The upright monitor and clear print makes the child's printed writing highly visible and readable, so that the teacher can read and evaluate how accurate the child's writing is in relation to particular rules of spelling, punctuation or paragraphing being emphasized. This "public" character of the child's computer writing also enables the teacher to assist the child in using a sentence or paragraph model. The accessibility of the child's text enables the teacher to praise and otherwise reinforce the child who demonstrates competence in a skill.

The ease of moving the cursor, deleting, and inserting text, make it very easy for the child to correct mechanical or spelling problems and still have a neat paper. This insertion feature -- that text "moves aside" to incorporate new material -- encourages the teacher to put sentence models, question sets, and story-frames directly on the computer. A teacher can file a series of guiding questions, the student can type in answers to each question and then can actually erase the questions, as a way to generate a rough paragraph. In using the story-frame such as the one in Figure 2, the student can "enter" any part of the frame, beginning at the beginning or middle.

## Impact on Writing Process

Our observations of children working within a skill-building approach argue that this approach limits children's involvement in the writing process and their sense of pride and ownership of the final product. Further, the word processor can easily become a "partner" in diminishing the child's involvement and ownership.

FIGURE 2

SENTENCE MODEL

| (Actor/Action) | | (Description/Actor/Action - past tense) |
|---|---|---|
| John | ran | Tall Alice jumped. |
| | jump | Short Alice jumped. |
| | climb | Skinny Alice jumped. |
| | stop | Bad Alice jumped. |
| | fall | |
| | trip | (Description/Actor/Action/How Acted) |
| | slip | |
| | iron | Lovely Tracey played joyfully. |
| | rollerskate | Friendly Alex was hurt badly. |
| | | Malicious Jill teased horribly. |

FIGURE 3

FRAME FOR CHARACTER DESCRIPTION

Frame for Character Description

_____ is (size). Her/his hair is (color). He/she wears (clothing) . He/she is (outstanding features).

He/she likes to (behavior). He/she doesn't like (behavior).

Most people say (what about him/her?) because _____.

Once (interesting event):

---

FIGURE 4

QUESTION SERIES

Directions: Write a complete sentence to answer each question.
After writing all the sentences, make up a title for your paragraph.

Your dream home.....

In which city is it located?
Is it close to the ocean, mountains, city, or country?
Is it a one or two-story house?
How many rooms does it have?
Do you have a swimming pool?
What is the best thing in the house?
Which room is your favorite?

In skill building activities, children's attention tends to be diverted from thinking about what they want to say to how they should say it. As a result, the involvement is not in composing but in producing correct spelling, punctuation or paragraph structure. This occurred, for example, when a teacher shifted a child's attention from the content of his description of a toy to a problem with pronoun reference and rules for using apostrophes. The children were to describe a toy so that the teacher could guess what it is.

Josh typed "It goes with He-Man figures
It has a snake on it."

Teacher: Instead of saying "it" "it" "it", why don't we say "this object" "this toy" let's think of another word besides "it."

Josh changes "It" to "This toy"

Josh: (aloud) It's like, the size of...Can I write "this toy" again?

Teacher: (nods)

Types: "Iam"

Josh: Oh, I didn't have to capitalize that. (starts to delete the word)

Teacher: You did have to capitalize that.

Josh: Oh.

Teacher: And how'm I going to know it's "I'm".

Josh: Oh, you separate that. (points to "I" and "am")

Teacher: What else is missing?

Josh: Oh, (types in apostrophe so that it now reads "I'a"m)

Teacher: Anything else? And do you get rid of any letters?

Josh deletes the "a"

Teacher: Good. Okay.

Josh: Now I forgot what I was going to say.

Josh's thoughts about the toy he is describing give way to preoccupation with how to start the sentence and whether a word should be capitalized.

The focus on skill-building is at odds with the kind of thinking and attention required in order for the child to stay engaged in developing what he wants to say. Given the level of anxiety that learning disabled children often bring to writing, the interruption of their composing to focus on skills could exacerbate their lack of confidence that they have something to say.

Although it might seem that providing a child with a format or frame for the final product would help him or her manage some of the organizational demands of writing, we observed a fairly low level of student engagement in such activities. In activities aimed at teaching children how to compose complete sentences, children frequently seemed disengaged from the content. In the example below, the teacher's monitoring comments maintain a focus on the sentence form rather than its content. As a consequence, the child never develops an investment in what he is writing about.

> Evan has just chosen a question set: "If I were a professional sports star..." and is sitting at the computer with the exercise paper beside him, reading aloud his first question.
>
> E: (reads) If I was a professional sports I wold play football. (He looks at the monitor then corrects the spelling of "wold" and inserts "star" after sports, then yawns)
>
> T: Great! You're noticing your mistakes!
>
> E: (reads the next question) "Why do you think that is the best sport for you?" and types, "Because I would make a lot of money."
>
> T: Is that a complete sentence?
>
> E: Yes.
>
> T: That's the way you like it? Somebody that didn't have that sheet might have difficulty knowing what you were talking about.
>
> E: (Deletes the complete sentence and retypes 'I would make a lot of money.')
>
> T: Okay, it's more a complete sentence.

The student completed the exercise because of the aide's gentle prodding. Throughout the activity, however, he showed signs of boredom and disinterest.

We observed more extreme cases of a child's disengagement from the content of the composing. For example, given an Actor, Action, Location sentence model, a child typed "The log fell into the house." Assuming that he must have intended something else and selected the wrong word, the teacher finally realized that the child had simply filled in words to fit the sentence pattern.

The computer is a willing partner in skill-building activities, by making the correction process easier; facilitating the teacher's monitoring of the child's accuracy and providing a more flexible format than a paper and pencil would for giving the child a sentence or paragraph frame. The problem is that the easy erase function tends to be used at the same time the child is attempting to compose a story. Project teachers suggested in fact that it encouraged them to demand more corrections than ever before.

The basic limitation of this approach is that in having their attention focused mainly on the form of the writing, children tend not to become engaged in the content. Rather than encouraging a generating of ideas, the "product models" appear to keep the child's attention on the appropriateness or accuracy of the product.

GUIDED WRITING

This approach involves helping children step-by-step through the composing process. The teacher often provides the child with a general topic, such as "write about someone important in your life," which the child then narrows. The teacher uses an intensive series of questions and prompts to guide the child through composing. The teacher thinks that writing should be practiced as a "whole" process, rather than by remediating isolated skills, but assumes that some children lack confidence in their ideas, and the ability to keep the composing process going on their own.

The assumption is that while "learning disabled" children have ideas to express, anxiety about their skills, lack of confidence that they have something to say, distractibility and difficulties with generating and organizing ideas make it difficult for them to engage in sustained composing. The teacher's role is to be a close partner in facilitating their generating and organizing process, until they acquire more skill and confidence.

Writing rules and conventions are a concern, but the teacher focuses on them once the child has completed a piece of writing that satisfies the child and responds to the writing topic.

Typical writing activities might be brief descriptions or stories, which begin with children writing down their initial ideas and images in short phrases or words. The teacher helps children with this "prewriting" brainstorming, encouraging them to talk about their ideas and then write them down as they verbalize them. When the child runs out of something to say, the teacher prompts them with praise or questions about what they have just written.

Despite the teacher's close involvement in the composing process, the focus on the child as "author" of the ideas enables him to own the product with pride. In one case, for example, a teacher was helping a child expand his ideas for a new writing project. Because his ideas were coming faster than he could type, she took over that role. Nevertheless, when they reviewed what was on the monitor, the child clearly claimed the writing as his own.

Computer Role

Several features of word processing programs facilitate this approach. As with the skill-building approach, the upright large printed text makes the child's writing "public" and accessible to the teacher. Instead of using this feature to look for errors, however, the teacher reads the text to engage

herself* in the content, and help the child in expanding it. The "movable text" feature of the computer facilitates a guided writing approach, where a teacher question may lead the child to insert or add text. When the child is dictating to the teacher, the monitor seems to provide a neutral writing ground. The print looks the same regardless of whether the teacher or the child types it -- which would not be the case with handwriting. The example cited in the skill building discussion, in which Steve completed sentences the teacher typed spontaneously into the computer, is an example of the kind of "shared writing ground" that is available with the computer.

Although our research was not designed to enable us to compare teacher styles of teaching writing with and without computers, our teachers feel that the computer stimulates a collaborative composing style, in the way that handwriting does not. The medium of handwriting is a more private one during the composing process. Teachers do not generally lean over a child's handwritten paper and add a question of their own, or read it aloud and suggest a new content direction.

Impact on Writing Process

The guided writing approach is aimed at keeping the child engaged in the composing process, and our observations suggest that it can be highly effective in doing so. In re-reading the text with the child, providing questions and prompts that directly build on what the child has already written, praising the child's ideas, and encouraging him or her to write them down, the teacher maintains the child's focus on the content.

This approach is very closely tailored to the individual child's anxiety level and level of writing fluency. With a child with more severe difficulty with composing the teacher may carry out an intensive dialogue that combines questions, praise, and even strong encouragement that the child write down what he has just talked about. The example below illustrates this kind of intensity.

---

* Feminine pronoun will be used throughout this report, as all of our participating teachers were female.

T: Let's think of questions we could ask about "snow."

S: (types "whote" then stops) Oh, I spelled "white" wrong.

T: Let's brainstorm about snow.

S: It falls from the sky.

T: Great, write that down.

S: (types in "falls out of the sky" then stops)

T: What else?

S: It's slushy.

T: Fantastic! Write it down.

She directs this child to type each word because the girl lacks a sense that her ideas are worth writing down.

For a child with stronger composing ability, but whose writing "breaks down" each time they end a train of thought, the teacher has the child "rehearse" and develop his/her thinking through intermittent conversations with her during the composing. In one activity observed, for example, the student wrote several sentences on the computer and then was unable to continue. After the teacher sat down and drew him out about his writing, he was able to sit down and write several more sentences.

Keeping the child in control of the composing process is critical in this approach. The teacher does this by basing her questions and prompts on text the child has already written, or ideas the child has raised, rather on directions that interest the teacher. For example:

Donald types: "We were playing in the snow."

Teacher: (reads his sentence aloud, and as she finishes it, Donald adds "the wet, slushy, snow") I love that -- but you know you could have been playing at school, you could have been playing in Arkansas!

Donald: We were playing in the park.

Teacher: Oh!

Donald adds "in the park."

Although the teacher suggests new content directions when the child "runs out of ideas," the child decides whether to pick up on them, and chooses the specific content. Given the close involvement of the teacher with the child's composing process in this approach, it is important that teachers not develop an "agenda" for the child's composition that is theirs rather than the child's. Cazden (1985) recently observed this problem in teachers' responses to children's oral narratives at "circle time."

Because the teacher's emphasis is on drawing out the child's ideas, the teacher can actually assume the "typist" role without taking away the child's sense of ownership. Particularly when the child is just acquiring keyboarding facility, and is expressing ideas faster than he/she can write them on the computer, the teacher may encourage the child to talk while she types. In the example below a boy is typing some ideas about having "unnormal powers" prior to writing a story about this. The teacher takes over the typing when it becomes clear that he is having difficulty thinking and typing simultaneously:

T: (Sitting beside Robin and pulling the keyboard toward her) Now, I'm going to be your fingers. If you had three wishes...

C: I wish I had the money touch...I'd be rich, no worries.

The teacher types "money touch, be rich, no worries"

C: I'd buy my mom, my sister some things...go around the world, see states.

The teacher types several country names as he mentions them.

C: Sometimes I get these unnormal powers... If I go somewhere and be late for home, I think real hard and be home!

The teacher types his words, then scrolls back the text so that he can see all that he has "written."

C: Oh my gosh! I did that!

The computer probably contributes to the child's ownership of this text. The "neutral" print on the monitor does not identify the typist as the teacher's personal script on a child's handwritten paper would.

Particularly for children who have difficulty generating ideas, who easily lose their train of thought, and who lack confidence in their ideas, the guided writing approach provides ongoing opportunities for the child to generate their own written content. The computer screen provides an accessible "neutral" ground for this intensive, collborative writing process.

As students begin to identify themselves as writers and are able to put their thoughts into writing more easily, teachers need additional techniques for helping them manage the writing process. The strategic approach, discussed below offers these.

STRATEGIC

Like the guided writing approach, the strategic approach involves children in a "whole" writing process. The focus of the approach, however, is to provide them with strategies for managing the writing process, rather than to guide them through actual composing. The strategies are designed to facilitate the different thinking processes required in writing, including choosing and focusing a topic, generating and organizing ideas, translating ideas into writing, revising and editing writing. Instead of giving the child a topic, the teacher provides children ways to "discover" topics that they want to write about. Rather than providing children with "product structures," which direct the form of their final writing products, the teacher offers "structures" which can help the child generate ideas, and then strategies for organizing them.

The strategic approach reflects the assumption, currently shared by many in the writing field, that writing is a process requiring several mental processes -- focusing a topic, planning for audience needs, generating ideas, translating those ideas into writing, reviewing what has been written and identifying "mismatches" with writing rules and conventions (Britton 1978; Emig 1977, 1978; Graves 1983, 1985a, 1985b). The Strategic approach, as we

observed it, tended to be consistent with recent models of the writing process that present writing as recursive rather than a linear process. That is, the process of generating and organizing of ideas, reviewing, etc. do not occur in a fixed sequence but recur through the composing and revision process (Flower and Hayes 1977, 1980, 1981; Hayes and Flower 1980).

The strategic approach assumes that learning disabled children are fully capable of developing and expressing ideas. What they lack are the strategies that more experienced writers, or children used to the school learning culture, bring to the writing process. They may also have "different" thinking strategies that get in the way of the writing process, but which do not indicate any basic inability to manage the writing process. These assumptions are consistent with a perspective on learning disabilities as "differences" that do not match smoothly with school practice, rather than as expressions of neurological damage (Christensen and Gerber 1985; Hallahan and Kauffman 1977; Shepard, Smith and Vojoir 1983). The strategic teacher's comments to children stress their basic capability --"Your mind is chock full of ideas...so full it's bursting" -- and attempt to provide them access to their idea-generating capabilities.

This approach also assumes that the anxiety and fear of failure that characterize the "learning disabled" child by the time they reach the upper elementary school years exacerbate their difficulties with the writing process. A child who is preoccupied with the possibility of error is unlikely to think fluently when writing.

To help them find a topic, teachers gave their students brainstorming strategies to use on the computer. For example, children were taught how to fill up the monitor with words that came to mind, until they thought of an event, person, or subject that they wanted to write about. Teachers also had students brainstorm a list of interesting subjects with her, or with other children, and file them in an "idea list" on the computer.

Teachers gave students strategies for generating and organizing ideas prior to their beginning composing on the computer. For example, the teacher showed children how to record sub-topics on individual file cards, and use the cards

to guide and focus their writing at the computer. For example, a child who was working on an autobiography brought in information from his mother about his childhood, and as he told these stories to the teacher, she wrote down the child's age and key identifying words for each incident on a file card, e.g. 2 years -- poured talcum powder on dog. The child then organized the cards sequentially and used one card at a time to trigger his direct composing on the computer. Occasionally teachers used visual strategies to help children generate ideas. When a girl had difficulty describing the tea room at the Ritz in a story, "Tea at the Ritz," the teacher suggested that she draw a map of the room, showing what people would see as they walk in. She then placed the "map" beside her at the computer and composed the description.

Computer Role

In contrast with the "skill building" structures, which teachers put "on line," none of the strategies described above were "on" the computer. They were introduced or demonstrated by the teacher, to be used with the computer, or as a way to facilitate composing on the computer. This is not to say that there might not, at some point, be a way to put these kinds of strategies "on line" as several researchers have been doing with "prompting" strategies. For example, Scardamalia et al (1982) first observed in their writing research that even a simple, contentless prompt, such as "What else would you like to say?" after children had written or dictated all they could, "led to their going on to produce about as much additional text as they had produced up to the point signaling began." (p. 202) On the basis of these dramatic results, they began developing software which presented prompting questions to the writer, during the composing process.

The simple word processing program used in the project nevertheless facilitated a strategic approach in a number of ways. It made an effective brainstorming strategy even more successful by reflecting the child's ideas back to him or her, in print that she/he can read. As with the guided writing approach, the accessibility of the child's print made it easier for the teacher to intervene when the child's writing process "broke down" and to suggest a strategy that might enable the child to continue. Although most of the activities we observed took place between teacher and one child, the

readable, accessible text, and the possibility of creating multiple printed copies could facilitate re-reading and discussion among children.

Impact on Writing Process

Our observations suggest that the strategic approach results in a high level of involvement and a strong sense of student ownership of the writing, provided the strategy is appropriate to the individual child. When given a structure for generating ideas that worked for them, children were able to carry on sustained composing, on their own on the computer. Although the three students who worked most consistently within a strategic approach did not have substantially different reading and writing abilities than other children in the study, they consistently worked more independently than other children when on the computer. The child who used the index cards to help him write his autobiography would work through a full class period at the computer, with only occasional questions or comments to the teacher. The girl who used a visual map to guide her description of the Ritz stayed highly engaged in generating new content for the story, despite her severe difficulties with spelling.

Possibly because these strategies served as resources, that is, they provide the child with a way to generate and organize their own content, the child evidenced a strong sense of ownership of the writing they produced in these activities. They consistently wanted to print out copies, to share their writing with the observer and with their families, and were willing to spend considerable time editing the pieces, once they were composed.

Many of the strategies described above are "cognitive" -- they give the child a way of thinking, whether retrieving, ordering, focusing or sequencing ideas. In the following example the teacher is reminding Seth of a strategy they had previously discussed for organizing a "character description" of a robot:

> Seth types a first sentence of a description: "You can never count on Longhaul to carry out missions. Longhaul wants to be in control of the Devastator."

Teacher: (walks by and reads his beginning) Remember that in a character sketch we should describe the inside as well as the outside?

Seth: Yeah. I always describe the outside last.

Teacher: Okay.

Others of the strategies were "conversational." Essentially, when children had difficulty translating their thoughts into writing, the teacher referred them back to their natural conversational repertoire. In the observation of the child composing "Tea at the Ritz" previously described, the teacher encouraged the child to think of "introducing" someone to the Ritz, and writing the description just as she might tell it to someone:

Teacher: I want you to think a minute. Look at your picture, and I want you to think about how you're going to introduce people (to it). You know how you introduce someone to a person? You tell a little bit about them. You're introducing people to the Ritz. Pretend you're talking to someone. You're telling them what it's like. Use your description.

When children were having difficulty putting their ideas into writing, the teacher might suggest that they stop and say it out loud to someone. In one instance of this kind a child was able to write what he meant more clearly by stopping to "talk" his idea to the teacher:

Donald has typed: "I would not like anything else to learn to cook"

Donald: Is that right? (Re-types the sentence as "I would not like anything else to cook.")

Teacher: How would you say it? Just say it to me.

Donald: I would not like to to learn to cook something new.

In these instances the teacher is drawing the child's attention to the common ground of talking and writing -- that both are communication -- and encouraging the child to use the more familiar and comfortable medium as a "bridge" to the more formal and abstract medium.

The challenge of this approach lies in developing the appropriate strategy for the individual child and at the appropriate time. The visual mapping of the Ritz was a highly successful strategy for that child, possibly because her thinking and writing tend to be very "visual." Her stories generally have very colorful, specific visual imagery. For a different child, a different strategy might have been more effective.

The power of this approach lies in helping the mildly handicapped child acquire in the remedial setting, a repertoire of basic cognitive strategies for managing the writing process in the mainstream classroom. The child whose writing process frequently breaks may be able to learn to consciously call on brainstorming, sorting, planning, and mapping procedures that can make writing a more fathomable and managable process.

## DISCUSSION: TOWARD A MODEL ENVIRONMENT FOR THE TEACHING OF WRITING WITH COMPUTERS

Teaching writing to learning-disabled students requires a substantial amount of teacher interaction, regardless of the perspective the teacher brings. It is the purpose of that teacher interaction which differentiates the approaches above. The skill building teacher's role was to directly teach writing skills and conventions expected of children at that grade level. The teacher's role in the "guided writing" context was to provide a structured social environment in which children receive continuous encouragement and feedback around specific writing tasks and, receive prompts and questions that enable them to expand their ideas in writing. The strategic teacher's role is to help the child manage the complex planning and decision processes involved in writing.

Both guided composing and strategic approach appear to foster intense engagement in composing and a sense of ownership in the writing that results. One helps the child acquire ways of managing the complex mental processes involved in writing; the other "walks" the child through the actual composing process, to model the composing process for the child, and provide very concrete and successful experiences with retrieving and expanding ideas in writing.

As a general approach for teaching writing with the computer, the skill building approach appears to have the least positive impact on students' involvement in the writing process and on their sense of ownership. The focus on specific skills, in isolation from a meaningful communication context, puts students' attention on complying with an appropriate rule or format rather than on what they are writing about. Providing forms that predetermine the final structure appear to inhibit rather than stimulate students' generating of ideas.

The word processor is not an instructional technique. Rather it is an extension of the teacher's approach. The skill building approach draws mainly on its revising and editing features. The guided writing approach capitalizes on the neutral writing ground it provides, and the easy insertion and addition of text that results from the teacher's expansions and suggestions. The strategic approach draws on the accessibility of the child's writing on the monitor which enables the teacher to intervene with appropriate strategies and lets the computer "mirror" children's ideas and capabilities back to them.

Together the strategic and guided writing approaches suggest directions for a teaching environment for mildly handicapped writers. The two approaches share several assumptions about writing and about learning disabled children, and together could provide teachers with a rich repertoire of specific ways to monitor and intervene in children's computer writing. It may be that the overarching approach should be strategic -- with the teacher teaching and providing strategies that help children find topics, recall information, generate ideas, organize thinking, etc. -- and that guided writing is used for children who are particularly anxious, those learning a new strategy, or those writing a first draft.

While improving children's knowledge of writing rules and conventions is one goal of all teachers at the upper elementary school level, this project's findings corroborate a current view that skills teaching cannot be equated with composing. This project has not yet fully analyzed the revision and editing processes taking place in our classrooms. Preliminary findings suggest that children will revise their writing, and focus for extensive periods on editing for mechanics and spelling, when working on a piece of

writing in which they are strongly invested. If this is the case, "skill building" should have a natural place, during the later stages of producing a piece of writing.

A model environment for the teaching of writing with computers, then, would be guided by:

- A set of principles about the nature of writing that would emphasize writing as a process of managing many different mental operations in order to achieve a communicative purpose;
- A set of assumptions about low-writing, and "learning-disabled" children which emphasizes their basic capability as "authors" and their greater need than most children to acquire skills in carrying out and coordinating the different mental processes involved in writing.
- A set of general approaches which include creating and modifying writing strategies appropriate to the individual child, and guiding the writing process in ways that keep the child in control.
- Specific procedures teachers can use in monitoring and intervening in the writing process, which are consistent with the above principles, assumptions and approaches.

In this kind of teaching context, computers can be partners in promoting a productive writing process for children.

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